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Bud and Boll-Shedding in Cotton

A PRELIMINARY ENQUIRY

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Bud and Boll-shedding in Cotton.

A Preliminary Enquiry.

(*Received for publication on 15th September, 1924.*)

Introduction.

At its inception, this enquiry had for its main purpose the determination of the percentage of bolls matured to flower-buds produced on each of a number of plants, with the object of isolating, if possible, a strain of cotton with a low shedding index, combined with high boll production.

As the work proceeded, it was noted that insect attack appeared to play an unduly large part in bringing about shedding. The scope of the enquiry was, therefore, enlarged. An endeavour was made to estimate the proportion of shedding due to insect attack, and incidentally the obvious external features of the phenomenon were brought under observation.

The enquiry was carried on through three seasons, and had reached a point from which definite experimental work could be started. Pressure of other work and exigencies of staff have made this impossible. For these and other reasons, it is unlikely that we shall be able in the near future to prosecute this enquiry further. We have, therefore, considered it desirable to publish, as a record, the results we have obtained.

We have to acknowledge our indebtedness to Mr. E. Ballard, till lately Government Entomologist, for deputing two members of his staff to aid us in collecting data during season 1921-22.

Material.

The work was carried out on the Central Farm attached to the Agricultural College and Research Institute, Coimbatore, between October 1920 and May 1923. The cottons used were Cambodia cotton (*G. hirsutum*) and progeny plants of the n^{th} generation of a cross between Cambodia cotton and Bourbon cotton (*G. purpurascens*). These latter, for other reasons, were selected for the similarity of their habit to that of Cambodia cotton.

In all three seasons sowing was completed between the 5th and the 9th of October, *i.e.*, at the normal time.

In 1921 the crop was uprooted by the 31st of July, in 1922 by the 31st of August and in 1923 by the 31st of May.

In each season the crop was irrigated as found necessary, and in all cases spacing was three feet each way.

It may here be stated that normally in the tract in which the station is situated, the cultivator obtains two crops of produce from the one plant crop in the year. The first, the main or season crop, is obtained from the flowers which are borne on the sympodial branches carried on the main stem and on the monopodial branches. The pickings from this first flower flush begin as a rule late in February or early in March and end in May.

The second or summer crop is obtained mainly from flowers produced on branches developed from buds on the main stem and on the monopodial branches which lay dormant during the first flush. As a rule, an interval of from four to six weeks, during which an odd boll or two may burst, intervenes between the last picking of the season crop and the first picking of the summer crop. The pickings from this second flush cease with the uprooting of the crop, the date of which is determined by law under the Pest Act.

In 1921 the date fixed for the uprooting of the crop was the 1st of August, and in 1922 and 1923 the 1st of September. In 1923 the crop on the station was, therefore, removed much earlier than the law demanded. This was done because the previous two years' experience showed that the produce of the second crop was badly attacked by insects, and was mainly composed of worthless material.

Method.

In 1920-21 as the intention at first was merely to obtain total figures for buds and bolls produced per plant, 703 plants scattered over a 3 acre field were selected. Of these, 514 were of the Cambodia variety and 189 Cambodia × Bourbon.

For each of these a record was begun of buds produced. Later, this was abandoned, 38 plants were set aside for more detailed examination, and work on the remainder limited to keeping records of flowers opened and bolls produced. The flowering record was kept daily, except on the 14th, 15th, 20th, 21st and 22nd of January when weather interfered. The bolling record was kept more irregularly, but in no case was the interval between pickings greater than four days.

The group of 38 plants set aside for detailed examination consisted of 28 Cambodia plants and 10 Cambodia × Bourbon plants. For each

of these a record was kept of buds produced, buds shed flowers opened, bolls shed and bolls burst.

For the reasons already given the bud production record was kept irregularly. During the period from the 16th December, 1920, up to the 25th January, 1921, the plants were examined a varying number of times, and at irregular intervals. From this date up to the 10th February, 1921, the examination was made every alternate day, and thenceforward every fourth day, except in April when on one occasion a six-day interval had to be allowed on account of heavy picking work.

The record of buds produced was closed on the 15th of May, but the history of all buds recorded up to and including that date was followed to the end.

The records of flowers opened and bolls burst were entered up daily.

In 1921-22, 40 plants were picked for detailed examination. Of these, 21 were Cambodia plants of strain No. 632, and 19 were Cambodia × Bourbon plants of strain No. 769. The total number of plants in these two plots were respectively 338 and 371. These two strains originated from single plants selected in the previous season, and protected from cross-fertilization, and were being tested for purity.

As before, for each plant a record was kept of buds produced, buds shed, flowers opened, bolls shed and bolls burst.

For this purpose the plants were examined daily up to the 4th February, 1922. Thereafter, owing to the rapidity of bud production, it was found impossible to complete the record of all the plants in the day. The two groups were, therefore, each divided into two lots, each of which was examined on alternate days.

The records of flowers opened and bolls burst were kept daily as in the previous year.

In addition to this the combined sheddings of each of the plants were collected daily, and a record showing the nature of the insect attack, if any, was maintained.

In 1922-23 the work of the previous season was repeated on 20 plants of strain No. 632. The plants were examined every day. In this year the record for insect attack was kept separately for buds and bolls shed, instead of a combined record as in 1921-22. Unfortunately an attack of Black-arm (*B. malvacearum*) showed itself about the 12th March, 1923. The records were continued until the 18th April, 1923; but, as by that time seven of the plants had died, and all were attacked, the work was stopped and the plants in this plot were uprooted and burnt. Our records are, therefore, not so complete as we would wish them to be. The choice of this strain was unfortunate, as although

it was surrounded on all sides by other Cambodia selections, it was the only one attacked by this disease.

The procedure finally adopted in maintaining the records may now be described. The recorders worked in pairs. At each examination the whole plant was gone over branch by branch, working from the lowest node on the main stem to the highest, one recorder took the plant, called out the number of the node, stated whether a branch had developed or not, and whether it was a monopodium or a sympodium. As each branch was reached, the recorder worked along it, node by node, calling out whether a flower-bud was present, or if one had been shed, or if a flower had opened, or whether a boll had shed or burst. As secondary branches developed from the nodes of the primary branches, each was dealt with in a like manner, before proceeding to the next node on the primary branch.

The other recorder had before him two sheets, one the "diagram" sheet and the other the "number and date" sheet. On the former a diagrammatic representation of the plant was drawn, which was added to as the plant grew. The "number and date" sheet was ruled lengthwise in groups of six columns. In the third column of each group of six, serial numbers were typed before the sheet was brought into use. As each bud developed the date was entered in the first column of the group alongside the appropriate serial number, and this number was entered on the "diagram" sheet in its proper place. If the bud shed, the date on which this was noted was entered in the second column, and a ring was drawn round the number on the "diagram" sheet. If the bud developed into a flower, the date of opening was entered in the fourth column. If later the boll shed, the date on which this was observed was entered in the fifth column, and again a ring was drawn round the number on the "diagram" sheet. The sixth column was reserved for the date of bursting of the mature boll, or the cause of shedding if the bud or boll shed.

Reference to Fig. I and Appendix I, where sample "diagram" and "number and date" sheets are shown, will make this procedure clear.

Thus when the plant was examined for bud-production at intervals and not daily, but was examined on each of the intervening days for open flowers and burst bolls, the serial number of the bud from which the flower or boll developed could be determined from the diagram sheet and the correct entry made in the "number and date" sheet.

Here it may be mentioned that only a few instances of shedding of open flowers were noticed. During the three years in which this enquiry was prosecuted only 38 open flowers were shed, out of a total of 9,979 flowers and bolls recorded as shed.

Conditions at this station, therefore, agree more closely with those reported by Harland [1] for St. Vincent and Lloyd [2] for Alabama, both of whom state that shedding of the open flower is only occasional, rather than with conditions in Egypt where Balls [3] reports that open flowers are extremely liable to shed.

Under boll-shedding, therefore, are included bolls of all sizes.

It is also necessary to record that in 1921-22 the work suffered from two sources of inaccuracy. A few bolls were eaten by jackals, and a few branches bearing reproductive members in different stages of development were broken while work was being carried on in the plots. This damage was not confined to one short interval, but was scattered throughout the period December to July, and out of an average of 681, affected 44 buds and 13 bolls. The numbers involved have been included in the bud-production and shedding curves.

As the damage was scattered the exclusion or inclusion of these numbers makes little difference to the curves and does not affect the general conclusions which can be drawn from them.

During the other two seasons jackals did no damage and only a very small amount of breakage occurred.

The Problem.

In carrying out this enquiry the aim we had before us was to arrive at an idea of the normal course of events in the life of the cotton plant between the time it begins to produce flower-buds and the time when its crop is ready for harvest. Having cleared the ground to this extent we then proposed to institute a set of experiments, based on the results obtained, designed to discover the causes of shedding, and, if possible, means of reducing loss on this account.

From the data collected, information on the following points has been obtained: (1) bud-production, (2) flowering and the time interval between the appearance of the bud and the opening of the flower, (3) bolling, including the time interval between the opening of the flower and the bursting of the bolls, and also information as to which buds are the most effective in producing bolls, and (4) shedding of buds and bolls, with periods of greatest liability to, and causes of, shedding.

These items will be discussed in turn, but before proceeding to do so, reference may be made to Fig. 2. There are shown in graphical form the rates of bud-production, bud-shedding, flowering, boll-shedding and bolling calculated to averages per plant per week.

[1] Harland, S. C. *West Indian Bulletin*, Vol. XVI, 1917.

[2] Lloyd, F. E. Environmental changes and their effect upon Boll-shedding in cotton: *McGill University Publications*, Series II (Botany) No. 6, 1921.

[3] Balls, W. L. *The Development and Properties of Raw Cotton*, 1915.

It will be noted that these curves are all more or less of the same form and are similar to those obtained by workers in other parts of the world. Each curve can be divided more or less definitely into two parts corresponding to the flushes, and each part shows a more or less gradual rise and fall. These points of general resemblance afford the scientific explanation of the every-day fact that two sets of pickings are obtained from the one plant crop.

Bud-production.

Before discussing results, attention has to be drawn to the fact that all calculations which depend upon records of the date on which the flower-bud was first noticed are subject to a definite error.

During the first two years we recorded the production of a bud when the form of the bud could be definitely made out or when its place was taken by a scar. In the third year we tried Mason's [1] plan of recording a bud when the surface of the attendant foliage leaf could be seen. Both methods have disadvantages. In both cases the effect of the error is to cause buds to be recorded as appearing at a later date than should have been the case.

Making allowance for this, however, it will be seen from the curves shown in Fig. 2 that the flower-buds begin to appear about six weeks after sowing and that by about the 18th March the first flush is finished. There is then a short interval when only a few buds are produced. This is followed by another period of vigorous bud-production which after reaching a climax gradually dies down and closes about the end of June.

These curves, as might be expected, also show that there has been some fluctuation in the total number of buds produced per flush. This point is more clearly brought out in the table shown in Appendix II, where in order to make possible a more complete comparison between the result of 1920-21 and those of the following years the data recorded have been arranged as averages per plant per flush for the different items investigated. There it will be observed that the flushes of 1921-22 were the heaviest and that in that year both flushes were equally heavy, whereas in 1920-21 the first flush was lighter than the second.

The difference from year to year is partially explicable by the fact that the crop occupied a different field each year and partly by differences in season.

In 1921-22 heavy rain amounting to 5·92 inches fell on the 5th February, 1922. At this time the plants were showing signs of having come to a standstill in growth and bud-production. Immediately after the

[1] Mason, T. G. Growth and abscission in Sea Island cotton: *Annals of Botany*, Vol. XXXVI, No. CXLIV, October 1922.

rain, growth began again and the plants very speedily put on a fresh green appearance. There is no doubt that had this rain not fallen the downward trend of the curve which had already begun would have continued and the peak shown against the 18th February would not have occurred. This flush would then have been lighter.

Soil and seasonal differences do not, however, explain the size of the first flush in 1922-23 which was the smallest of all. In this year the rainfall was higher and better distributed and the field chosen was as good as that on which the crop was grown in 1920-21. Nor can the attack of Black-arm be held responsible as it did not show itself until well after the bud-production curve had assumed a downward tendency. The most probable explanation lies in the severity of the attack of the spotted boll-worm (*Earias*, spp.).

For the sake of completeness it may here be explained (1) that the caterpillar of this moth begins its attack on the cotton plant by boring through the vegetative buds into the stems and branches of the young seedlings, its favourite point of attack being near the apical bud; (2) that it continues this attack until the flower-buds become numerous when it deserts the scaffolding for the buds, which in turn are deserted as bolls become plentiful; and (3) that the Cambodia cotton plant is distinctly sympodial in habit: the first flowering branch most commonly arises at the 6th or 7th node above, but not including the seed-leaf node and as a rule only three or four monopodial branches are developed.

Now according to the stage at which the attack is begun the plant may be topped at a point which will permit of one or more sympodial branches being developed on the main stem or so low down that it will be able to produce monopodia only from three or four nodes. In the latter case the monopodia have to develop, grow and produce flowering branches before flower-buds can be produced in any number.

When the attack is severe the scaffolding may consist of a short length of main stem with from three to five monopodial branches. It is obvious that under these conditions the production of buds will be delayed and will not reach such a high maximum. In 1922-23 these conditions were fulfilled and not a single plant escaped attack. In 1920-21 some plants were not topped and many escaped with a very light attack.

Reference has already been made to the fact that the buds produced during the second flush were mainly borne on sympodia developed from buds on monopodia. In the table prepared below is given an analysis of the buds, flowers and bolls produced in each flush, in averages per plant, showing what portion of the crop was borne on sympodia carried by (*a*) the main stem and (*b*) the monopodial branches.

TABLE I.

	First flush						Second flush					
	Main stem			*Monopodia*			*Main stem*			*Monopodia*		
	Buds	Flowers	Bolls	Buds	Flowers	Bolls	Buds	Flowers	Bolls	Buds	Flowers	Bolls
1920-21.												
Cambodia . . .	82	30	16	94	20	9	12	4	1	218	63	11
Cambodia × Bourbon .	84	29	18	101	22	14	20	7	3	269	82	26
1921-22.												
Cambodia . . .	95	46	11	245	68	14	11	7	1	330	151	18
Cambodia × Bourbon .	74	38	12	207	68	18	5	3	..	281	149	21
1922-23.												
Cambodia . . .	3	1	1	102	49	8	..	..	..	..	..	..

This table shows very clearly that the sympodial branches borne on the monopodia are responsible for practically all the crop produced, during the second flush. It also shows that in 1921-22 the extra buds produced as the result of the heavy rain mentioned above were borne on sympodia developed from buds on monopodial branches and that these buds were of little value. This point will be referred to again. The figures for 1922-23 show how severe was the attack of the spotted boll-worm Actually only two plants produced flower-buds on sympodia arising from the main stem. The diagram shown in Fig. I represents the better of these two plants.

Flowering.

The flowering curve reproduces the bud-production curve with a deduction for buds shed and with a definite lag representing the time interval required for the bud to develop into the open flower. Examination of the chart given in Fig. 2 shows that this time interval is roughly about one month. This is as close a correspondence between these two curves as can be expected, considering that so few plants could be examined, that as will be shown later a bud is liable to shed so long as it remains a bud, that the interval between the appearance of the bud and the opening of the flower not only fluctuates widely from bud to bud but also varies as the season advances, and that the time unit chosen in preparing the chart is one week.

More definite information on this point can be gathered by calculating the interval between the appearance of the bud and the opening of the flower for each bud and tabulating the result. This has been done for the years 1921-22 and 1922-23. The tables so prepared are shown in Appendix III. For the sake of economy the tables for strain No. 632 alone are given. The results for strain No. 769 for 1921-22 differ only in slight details. In these tables the date given at the head of each column is the end date of the three-day period during which the buds were produced. The numbers entered in the column are the numbers of these buds which flowered after the interval indicated on the left of the table.

From these tables it will be seen that there is a tendency, very pronounced in 1922-23, for this interval to shorten as the season progresses from the beginning of the first flush to the beginning of the second. From this point until towards the end of the second flush the length of this interval remains fairly stationary and then shows a tendency to increase. This is more clearly shown in Fig. 3 where the fluctuations in the average interval entered at the foot of each column in the table are depicted graphically.

It will also be seen from these tables that between the middle of February and the middle of March a number of buds occur which take a very long time to develop into open flowers. These are dormant buds which grow large enough to be definitely noted as buds and then cease to grow for a considerable time. In calculating the average interval all buds which took 50 days or longer to develop into an open flower were omitted. This is a purely arbitrary decision based on the fewness in number of such buds. Even so, owing to the small number of buds produced during this period the graphs of 1921-22 fluctuate considerably in that section.

There are two other marked fluctuations of these graphs which cannot be explained in this way and which appear to be significant. These occur against the periods 26th December—4th January and 19th January—3rd February. Considering that the examination of these two groups of cottons was carried out by two groups of recorders working independently and that the corresponding graph for 1922-23 is so free of marked fluctuations some explanation of the occurrence of these two definite rises seems to be called for. Examination of the rainfall record (Fig. 4) for 1921-22 shows that 1·28 inches of rain fell on the 10th and 11th of January, 1922, and 5·92 inches on the 5th of February. It is suggested that the development of the buds produced in these two periods was in each case retarded by the rain which fell shortly after they appeared. Further investigation is necessary before a definite statement can be made. The point is of importance in regard to crop forecasts. In this particular instance the retardation amounted to only two and four days respectively. It is possible that a more prolonged period of wet weather with an accompanying fall in temperature would have a more pronounced effect and would definitely delay the arrival of the crop on the market.

Further indication that the flowering interval tends to shorten as the season progresses from the beginning to the end of the first flush is afforded by determining the interval between the flowering of successive nodes on the sympodial branches. The results so obtained for the two groups of cottons examined in 1921-22 are shown in the following table. They show that the time interval between the flowering of two adjacent nodes decreases as the distance from the main stem increases: a directly opposite result to that obtained by Harland [1] for Sea Island cotton.

Referring back to the flowering curves in Fig. 2 it will be observed that more flowers open in the second flush than in the first and that flowering began much later in 1922-23 than in 1921-22. From the data we have at our command it is not possible to give an explanation of the first point. It is possible that the fact that flowering reaches its maximum more quickly and that the time taken for a bud to develop into a flower is shorter, in the second flush than in the first, has some bearing on the question. Further investigation is necessary. In regard to the second point it has already been shown that bud production was slow and scanty in 1922-23. If to this is added the fact that the earlier flowers were attacked by the spotted boll-worm and shed, a sufficient explanation is afforded.

[1] Harland, S. C. *Loc. cit.*

TABLE II.

	Nodes	Days 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Total cases	Average interval Days
Strain No. 632	1 & 2	..	..	..	..	1	8	**20**	21	29	13	6	4	5	4	..	..	..	..	111	9·9
	2 & 3	..	..	..	1	9	12	32	19	11	9	5	2	2	1	2	..	1	..	106	9·1
	3 & 4	..	..	1	1	3	18	26	23	18	9	8	1	1	2	..	..	1	1	113	9·2
	4 & 5 (*a*)	..	..	..	3	3	14	25	31	12	7	2	2	3	2	..	..	..	..	105	8·9
	5 & 6 (*b*)	1	..	2	1	3	12	14	17	10	4	4	2	..	..	..	1	..	..	71	8·6
Strain No. 769	1 & 2	..	..	..	3	..	8	16	14	18	11	1	2	..	2	..	1	..	..	76	9·4
	2 & 3	..	..	..	2	5	10	14	17	17	8	3	1	..	..	2	1	1	..	81	9·3
	3 & 4 (*c*)	1	..	1	1	..	13	18	20	13	4	4	1	..	..	1	..	..	..	78	8·8
	4 & 5	..	..	..	..	6	12	20	18	14	2	5	2	2	..	..	..	..	..	81	8·9
	5 & 6	..	..	2	..	2	4	13	13	7	6	2	..	..	..	..	..	..	..	51	8·9

(*a*) One interval of 22 days.
(*b*) One interval of 25 days and one of 80 days. } Excluded in calculating averages.
(*c*) One interval of 27 days.

In preparing this table the first 20 sympodia only on the main stem were taken as very few figures were obtained for the higher sympodia. The numbers obtained for nodes beyond the sixth were also few and have, therefore, not been shown.

Bolling.

The bolling curve is the resultant of all that has gone before. It reproduces the flowering curve with a deduction for boll-shedding and with a lag corresponding to the time taken for the boll to mature from the open flower. According to the curves shown in Fig. 2 this lag appears to be equal to about six weeks. Actually, as will be seen by reference to Appendices IV and IVa, * the interval between the date of opening of the flower and the date of bursting of the boll shortens from 60 days to about 40 days as the season progresses from December to April, and then lengthens again.

As shedding is heavy and no more than 5—17 per cent., according to season and flush, of the buds produced mature into bolls, the bolling curve tends to become flat and uninteresting. Its most salient feature is the higher maximum reached in the first as compared with the second half of the season. By eliminating the time interval, however, and rearranging the results so as to show the number of buds produced per plant per week, the number of flowers produced from those buds and the number of bolls matured from these flowers a further interesting point is made evident. In Fig. 5 is shown the result of this rearrangement. It will be seen that so far as the first flush is concerned the earlier flower-buds are more effective in producing bolls than the later and that the period of greatest efficiency is from about the 17th of December to the 28th of January. It is also abundantly evident, as has already been pointed out, that in 1921-22 the buds produced between the 11th and the 25th of February were of little use in producing crop.

Shedding.

Shedding is extensive and both buds and bolls are affected. Bud-shedding begins with the appearance of the buds and boll-shedding very shortly after flowering has begun. The most interesting features about the curves of shedding are that they tend to synchronize and that they reach their maxima after the budding and flowering curves. The latter is not so apparent in the second flush as in the first. The position is complicated by the fact that the insect pest population is much higher in the summer and appears to cause more shedding.

The first feature indicates that the same agency is at work in both cases: the second probably indicates that at this stage when the growth of the plant has begun to slow down the plant is carrying many more

* Here again it is not necessary to show more than one group. The results during all three seasons and for the different groups are alike.

reproductive members than it can possibly mature and a process of natural pruning sets in. Similar observations in regard to Sea Island cotton have been made by Mason.†

Liability to shedding.

(1) *Buds.* As was done in the case of flowering, the interval between the appearance of the bud and the date on which it shed has been calculated for each bud shed and a table prepared. Again for the sake of economy the results for the Cambodia group in 1921-22 alone are shown in Appendix V as these are typical of all. In considering this table it has to be mentioned that there is not only the error in observation of the appearance of the bud to which reference has already been made to be taken into account but also that there is an error in observation of the date on which the bud was shed. Many small buds do not fall off the plant but wither and remain attached. Such buds were recorded as shed when they were definitely noted to be withering. In many cases the bud had withered before its presence was recorded owing to the neighbouring buds having prevented it being seen. The numbers against the age 0 days, therefore, include all buds which actually shed or were totally or partially withered on the day their appearance was recorded or as evidenced by a scar were found to have shed previously. These sources of error do not, however, affect the general conclusions which may be drawn from this table, *viz.*, that the range of fluctuation of age at shedding is very wide and that a bud is liable to be shed so long as it remains a bud. The wide range of fluctuation is explained by the dormant habit of some of the buds to which reference has already been made.

The frequency arrays for age at shedding prepared for each group and flush for 1921-22 and 1922-23 have been tabulated and are shown in Appendix VI.

The results given there plainly indicate (1) that the bud is very liable to shed when it is very young, (2) that once it is past this point the liability is considerably reduced but gradually increases until between the 9th and the 11th days it is as great as ever and (3) that after the 11th day the liability gradually decreases. These observations differ from those of Lloyd ‡ and Mason § who found only one period of great liability to shedding, the first, when the buds were very young. Under their conditions once this period was passed the liability to shedding gradually decreased.

† Mason, T. G. *Loc. cit.*
‡ Lloyd, F. E. *Loc. cit.*
§ Mason, T. G. *Loc. cit.*

It will also be noted that more buds are shed in the first flush than in the second.

(2) *Bolls.* In the case of boll-shedding the chances of error in observation are small. The date of flowering is definite and in the majority of cases the date of shedding is equally definite. Only in a few cases did the bolls dry up and remain attached to the plant.

As was done for bud-shedding, tables for each group and flush have been prepared. As these are all similar the tables for the Cambodia group in 1921-22 are alone shown in Appendix VII. From this table it will be seen that there is a tendency for this interval to shorten as the season advances. This is more clearly seen from examination of the graph shown in Fig. 6, which has been prepared by combining the results of both groups, Cambodia and Cambodia × Bourbon, for 1921-22.

This result bears a striking resemblance to those obtained for the interval between (1) the appearance of the bud and the opening of the flower and (2) the opening of the flower and the bursting of the boll. There is a common tendency for the interval to shorten from December to about the end of March, to remain fairly steady during April and May and then to lengthen. Reference to Appendix VII shows that there is a gradual rise in temperature from December to about the end of March, it then remains fairly steady through April and May after which it begins to fall. This indicates a very definite correlation between temperature and length of interval but in the absence of information as to other possible factors it cannot be taken as absolutely proved that temperature is the controlling factor.

The only other feature of boll-shedding which calls for comment is the higher rate which occurs in the second flush as compared with the first. This appears to be due to the heavier attack of insect pests which by that time are present in considerable numbers.

Causes of shedding.

Our investigations into the causes of shedding were, as has already been stated, limited to endeavouring to determine to what extent insects were responsible, that is to say, in endeavouring to ascertain, for the conditions prevailing at this station, what proportion of the numbers shed might be expected to show evidence of insect attack and when this attack was likely to take place.

No attempt could be made to decide whether the insect attack was the actual cause of the shedding or whether, as might well be the case,

the process of shedding had actually begun before the attack took place.

As in 1921-22 separate records were not maintained for buds and bolls; the results obtained (Fig. 7) have been shown as percentages of shed numbers recovered. Not all were recovered, there were always two or three each day which could not be found.

In 1922-23, separate records were kept for buds and bolls. The curves shown in Fig. 8 give the actual figures for total numbers shed, unattacked, attacked by pink boll-worm, spotted boll-worm, and *B. malvacearum*.

It will be noted that in both years by far the greatest proportion of the numbers shed were apparently unaffected by any disease or pest and that of those attacked by insects the damage was done by the spotted boll-worm in the majority of cases. It will also be observed that the spotted boll-worm produced its greatest effect in the early part of the season when bud-production is low.

Thus if attention is confined to figures alone it would appear that insect attack as a possible cause of shedding is of minor importance as compared with those factors which have been labelled unknown. It has, however, yet to be determined whether shedding due to the latter is in any way avoidable either in whole or in part. Moreover, the importance of the spotted boll-worm should not be assessed by comparative figures. Its chief importance lies in the fact that it definitely delays the commencement of harvest by its attack on the scaffolding of the plant and appears to cause delay by attacking the early flower-buds.

Late cropping on account of the shedding of the early flower-buds may be as unavoidable as shedding due to unknown causes as it is possible that these buds would still be shed even if the spotted boll-worm were absent. Our only attempt to test this point by growing plants in a wire-gauze cage ended in failure. The plants grew abnormally and very soon came into contact with the gauze through the mesh of which insects were able to deposit their eggs in the plants.

The importance of any factor likely to cause the crop to be late lies in the fact that in this tract rainfall is frequently in defect. When this happens the level of the water in the wells, which are deep, falls considerably by the month of February and continues to fall. Great difficulty is then experienced in providing the crop with an adequate supply of water. As this period of shortage of water coincides with the period of ripening of the bolls, it is obvious that the longer the latter is delayed the greater will be the depreciation of the quality and quantity of the harvest.

Summary.

As a preliminary to a detailed investigation of the problem of bud and boll-shedding, the development of the cotton plant has been studied during three seasons, the study being limited to the above ground portions of the plant. Plants of the Cambodia variety (*G. hirsutum*) and of Cambodia-like selections from a cross between this variety and Bourbon (*G. purpurascens*) were used.

A detailed description of the methods employed in carrying out this enquiry and of the manner in which the records were compiled has been given. For the latter purpose two sheets were opened for each plant, one, the "number and date" sheet, on which were entered in columns, (1) the date of appearance of the bud, (2) the date of shedding of the bud, if shed, (3) the number of the bud, (4) the date of opening of the flower, (5) the date of shedding of the boll, if shed, and (6) the date of bursting of the boll or if shedding had occurred, whether the bud or boll was attacked by pest or disease or not; the other, the "diagram" sheet, carried a diagrammatic representation of the plant which was built up *pari passu* with the growth of the plant, and on which the position of the bud was indicated by the entry of the number given on the number and date sheet.

It is shown that in broad outlines the development of the cotton plant at Coimbatore follows the same course that it appears to do wherever cotton is grown. If allowed to do so the plant will produce two flushes of buds, flowers and bolls in the year, the development of which if depicted graphically gives the typical roughly bi-modal curves familiar to the worker on cotton.

The results are discussed in detail under the heads (*a*) bud-production, (*b*) flowering, (*c*) bolling and (*d*) shedding.

(*a*) *Bud-production.* The date of appearance of the flower-bud is found to suffer from an unavoidable error in observation. Buds begin to appear about six weeks after sowing *i.e.*, late in November or early in December. The first flush finishes about the middle of March and the second about the end of June. The buds produced during the first flush are carried on sympodial branches, borne on the main stem and on the monopodial branches, while in the second flush very few buds are produced on the sympodial branches arising from the main stem. The number of buds produced per flush is found to vary with the season and the flush. It is shown that untimely rains in 1921-22 caused a heavy increase in the number of buds produced in the first flush without a proportionate increase in crop, and that the attack of the spotted bollworm (*Earias*, spp.) causes the appearance of the flower-buds to be delayed.

(*b*) *Flowering.* The interval from bud to flower decreases from about 35 days at the beginning of the first flush to about 25 days at the beginning of the second flush, it then remains stationary until towards the end of the second flush when it begins to lengthen again. Some buds apparently pass through a period of arrested development and take more than 50 days to develop into open flowers. There is some indication that rainfall, possibly by causing a drop in temperature, slows down the rate of development of the flower-bud. It is shown that the time interval between the flowering of adjacent nodes on the same fruiting branch decreases as the distance from the main stem increases.

(*c*) *Bolling.* The interval from flower to boll shortens from about 60 days to about 40 days between December and April, it then begins to lengthen again. It is shown that a small percentage only of the buds produced mature into bolls, from 5 to 17 per cent. according to flush and season, and that the buds which appear in the interval between the 17th December and the 28th January are the most efficient in developing into bolls.

(*d*) *Shedding.* Both buds and bolls are affected. Bud shedding begins with the appearance of the buds and boll-shedding very shortly after flowering begins. The former is greater than the latter in the first flush. In the second flush the position is reversed. It is found that the curves showing the rate of shedding of buds and bolls tend to synchronize with one another. This is held to indicate that the same underlying cause is at work in both cases. It is also found that shedding does not begin to be serious until after the growth of the plant has begun to slow down as indicated by the falling off in the rate of bud-production.

It is shown that the bud is very liable to shed when very young but that once it is past this point the liability is considerably reduced. It gradually increases again however until, between the 9th and 14th days after the bud appears, it is as great as ever. After this age the bud becomes less and less liable to shed. In the case of bolls it is found that the interval between the opening of the flower and the shedding of the boll shortens from 12 to 7 days as the season advances, and then lengthens again.

The similarity of this result with the results obtained for the interval from bud to flower and from flower to burst boll is discussed. It is shown that as the temperature rises the interval shortens, that during the period when the temperature remains fairly stationary the interval tends to remain stationary and that as the temperature falls the interval lengthens.

It is shown that the majority of the buds and bolls shed are apparently unaffected by any pest or disease, and that of those attacked by insects the damage in most cases was done by the spotted boll-worm which was found to be most active early in the season and appeared to be largely responsible for the shedding of the early flower-buds. It is pointed out that the damage done by the spotted boll-worm is important from the point of view of yield and quality of produce.

Appendix I.

Plant No. 632, 2/17.

1	2	3	4	5	6	1	2	3	4	5	6
21st Nov.	29th Nov.	1	..	..	S	31st Dec.	..	36	29th Jan.	19th Feb.	X
23rd Nov.	30th Nov.	2	..	..	S	Do.	31st Dec.	7	..	..	S
27th Nov.	27th Nov.	3	..	..	S	Do.	24th Jan.	8	..	..	S
29th Nov.	29th Nov.	4	..	..	S	Do.	..	9	28th Jan.	..	18th Mar.
Do.	29th Nov.	5	..	..	S	Do.	..	40	1st Feb.	11th Feb.	M
30th Nov.	30th Nov.	6	..	..	S	Do.	2nd Jan.	1	..	..	S
4th Dec.	..	7	20th Jan.	13th Feb.	M	Do.	..	2	20th Jan.	..	21st Mar.
5th Dec.	5th Dec.	8	..	..	X	Do.	..	3	30th Jan.	..	22nd Mar.
Do.	26th Dec.	9	..	..	S	1st Jan.	20th Jan.	4	..	..	D
6th Dec.	31st Dec.	10	..	..	S	2nd Jan.	..	5	4th Feb.	12th Feb.	X
7th Dec.	30th Dec.	1	..	..	S	4th Jan.	4th Jan.	6	..	..	S
8th Dec.	16th Dec.	2	..	..	S	5th Jan.	18th Jan.	7	..	..	S
10th Dec.	30th Dec.	3	..	..	S	Do.	..	8	4th Feb.	13th Feb.	X
13th Dec.	13th Dec.	4	..	..	S	6th Jan.	..	9	5th Feb.	13th Feb.	X
19th Dec.	31st Dec.	5	..	..	M	Do.	..	50	7th Feb.	19th Feb.	X
20th Dec.	..	6	17th Jan.	26th Jan.	X	Do.	10th Feb.	1	..	..	X
Do.	19th Jan.	7	..	..	S	Do.	..	2	8th Feb.	15th Feb.	X
21st Dec.	21st Dec.	8	..	..	S	Do.	..	3	6th Feb.	16th Feb.	X
Do.	21st Dec.	9	..	..	M	7th Jan.	11th Jan.	4	..	..	S
23rd Dec.	25th Jan.	20	..	..	S	Do.	7th Jan.	5	..	..	S
Do.	..	1	22nd Jan.	..	20th Mar.	Do.	30th Jan.	6	..	..	X
Do.	..	2	22nd Jan.	..	20th Mar.	Do.	..	7	6th Feb.	13th Feb.	X
24th Dec.	6th Jan.	3	....	..	S	Do.	..	8	7th Feb.	16th Feb.	X
Do.	1st Jan.	4	..	..	S	8th Jan.	..	9	7th Feb.	..	30th Mar.
Do.	..	5	21st Jan.	..	14th Mar.	Do.	..	60	8th Feb.	..	27th Mar.
Do.	..	6	23rd Jan.	..	18th Mar.	Do.	..	1	9th Feb.	..	25th Mar.
26th Dec.	..	7	24th Jan.	..	18th Mar.	9th Jan.	..	2	8th Feb.	12th Mar.	Br.
27th Dec.	..	8	4 th Jan.	20th Jan.	S	Do.	..	3	7th Feb.	16th Feb.	X
Do.	27th Dec.	9	..	..	S	Do.	..	4	10th Feb.	20th Feb.	X
28th Dec.	..	30	27th Jan.	..	2nd Mar.	Do.	23rd Jan.	5	..	..	S
29th Dec.	..	1	27th Jan.	..	21st Mar.	Do.	..	6	7th Feb.	21st Feb.	X
Do.	..	2	30th Jan.	..	27th Mar.	10th Jan.	27th Feb.	7	..	..	D
Do.	..	3	28th Jan.	1st Feb.	Ch.	Do	..	8	8th Feb.	17th Feb.	Y
Do.	..	4	29th Jan.	..	24th Mar.	Do.	..	9	12th Feb.	8th Apr.	Br.
..	..	4	..	..	S	11th Jan.	..	70	10th Feb.	..	4th Apr.
31st Dec.	17th Jan.	35	..	..	S						

Co. 1 Date of appearance of bud.
2 Date of shedding of bud.
3 Bud number.
4 Date of flowering.
5 Date of shedding of boll.
6 Date of bursting of boll or cause of shedding.

Br. = Broken.
Ch. = Cheriba.
D = Dried.
F = Blackarm.
M = Missing.
S = *Eaten.*
X = Not known.

APPENDIX II.

		1920-21				1921-22				1922-23	
		FIRST FLUSH		SECOND FLUSH		FIRST FLUSH		SECOND FLUSH		FIRST FLUSH	
		Range	Average	Range	Average	Range	Average	Range	Average	Range	Average
Cambodia	Buds per plant	79—273	176	97—433	230	180—661	340	159—511	341	59—216	105
	Buds shed	60—79	71	52—87	71	60—76	67	44—65	54	39—77	52
	Flowers opened	24—94	50	40—119	67	54—217	114	74—254	158	17—86	50
	Bolls shed	30—66	51	64—94	82	68—89	77	76—94	89	71—90	83
	Bolls matured	13—38	25	4—20	12	13—50	25	9—35	19	3—19	9
	Bolls to buds	9—20	14	2—12	5	4—11	8	3—10	6	4—12	8
Cambodia × Bourbon	Buds per plant	70—321	185	176—496	289	147—452	281	189—445	286	..	..
	Buds shed	57—79	73	53—76	68	49—75	62	41—54	47	..	..
	Flowers opened	19—78	51	67—151	89	60—176	106	105—218	152	..	..
	Bolls shed	3—50	37	43—82	68	66—80	72	73—94	86	..	..
	Bolls matured	13—47	32	13—51	29	18—44	30	6—39	21	..	..
	Bolls to buds	13—23	17	5—16	10	7—15	11	3—15	7	..	..

Appendix III.

Interval from bud to flower. Strain No. 632. 1921-22.

Days	November			December										January										Feb.
	23	26	29	2	5	8	11	14	17	20	23	26	29	1	4	7	10	13	16	19	22	25	28	31	3
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	1	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	1
20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	1	2	3	1	..	1	1	..
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	1	4	3	2	..	..	..	1
24	..	..	..	..	..	..	..	..	2	1	..	1	1	..	..	2	..	2	4	1	..	..	..	1	1
26	..	..	..	..	..	..	..	..	3	3	4	3	2	1	3	2	6	10	11	5	3	..	1	2	3
28	..	..	..	..	..	3	1	..	9	12	14	11	10	9	5	27	11	33	33	30	11	4	7	10	16
30	..	..	..	..	..	10	7	9	7	22	14	22	23	18	38	37	39	70	44	63	20	3	14	16	9
32	4	3	1	3	6	14	17	6	6	11	13	13	15	24	39	26	22	26	34	52	34	3	6	11	15
34	7	7	2	10	12	12	7	6	9	2	8	2	17	11	9	8	16	11	4	16	28	8	10	13	3
36	10	5	4	3	5	2	2	3	2	3	5	..	1	5	4	..	4	..	..	9	19	5	4	10	..
38	2	3	3	..	2	2	2	2	..	..	1	..	..	1	2	..	2	..	1	2	6	7	2	..	1
40	..	1	1	1	1	3	..	..	1	..	..	..	1	..	2	..	..	..	..	1	3	3	..	..	1
42	1	1	1	..	1	1	..	..	..	..	..	1	..	..	..	..	..	..	..	2	1	..	1	..	..
44	1	..	..	..	..	1	2	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..
46	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..
48	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
50	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..
52	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
54	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
56	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
58	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
60	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
62	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
64	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
75	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
TOTAL	24	18	12	17	26	46	38	20	39	54	60	53	70	69	102	103	101	153	133	184	137	33	45	64	50
Average	35·3	35·9	36·3	34·4	34·9	34·7	35·0	35·8	32·7	32·1	32·5	32·1	33·1	33·6	33·5	32·1	32·9	31·8	31·6	32·9	34·8	36·4	33·6	33·4	32·0

APPENDIX III—*contd.*

Interval from bud to flower. Strain No. 632. 1921-22.

Days	February								March										April						
	6	9	12	15	18	21	24	27	2	5	8	11	14	17	20	23	26	29	1	4	7	10	13	16	19
14	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	1	..	1	2	2	2	4	..	..	..
16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	3	..	1	4	4	2	1	1	..
18	..	..	1	..	..	..	..	..	1	..	1	..	..	1	2	2	2	3	4	4	4	2	1	7	2
20	2	1	..	1	..	..	..	..	..	..	1	..	..	1	4	..	1	..	5	6	8	13	10	3	4
22	..	..	2	..	1	..	..	..	..	1	..	..	1	1	1	2	1	14	10	14	6	24	17	8	6
24	2	3	3	1	..	1	..	1	..	4	2	1	1	1	7	9	9	23	18	11	14	37	30	11	11
26	..	3	6	6	..	1	..	3	2	2	3	3	2	2	8	11	17	37	11	10	10	36	42	20	27
28	11	19	17	7	3	1	2	6	3	5	6	4	6	3	7	14	14	34	7	..	4	39	42	34	34
30	24	17	15	3	2	2	2	6	3	3	4	6	3	2	2	12	6	16	2	..	7	41	38	11	11
32	31	11	13	7	9	2	4	2	2	1	6	12	2	..	2	2	3	5	2	..	3	30	11	1	4
34	13	4	9	6	5	7	6	..	2	2	3	1	1	1	2	1	1	3	2	..	1	17	1	2	2
36	2	2	7	2	4	4	..	1	..	..	6	3	2	1	2	1	..	1	..	..	1	8	..	..	..
38	..	..	1	..	3	4	1	1	..	1	3	4	..	1	..	..	1	1	..	..	..	3	1	..	2
40	..	..	2	..	..	3	..	..	1	..	4	1	..	..	1	..	..	1	..	1	..	1	..	..	1
42	..	..	..	..	1	..	..	2	..	1	2	..	..	..	..	..	..	..	..	..	..	..	2	..	..
44	..	..	1	..	..	..	..	..	3	1	2	..	..	1	..	1	2	..	..	..	..	..	..	..	..
46	..	..	..	..	..	..	3	..	..	..	3	..	..	1	..	1	..	1	1	1	..	..	..	..	..
48	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	1	..	..	..	..	..	..	..	..	..
50	..	..	..	..	..	..	..	..	2	1	..	..	1	..	..	1	..	..	..	..	..	..	..	..	..
52	..	..	..	..	1	1	..	..	1	..	1	..	1	..	..	..	..	..	..	..	..	..	..	..	..
54	..	..	..	..	1	..	..	..	1	..	1	1	..	..	..	..	1	1	..	..	..	..	..	1	..
56	..	..	..	..	..	1	1	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..
58	..	..	..	..	1	..	1	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..
60	..	..	..	..	..	1	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1
62	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..
64	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
75	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
TOTAL	85	60	77	33	31	31	20	22	25	24	54	37	22	15	38	58	61	141	65	57	164	168	96	155	130
Average	30·8	29·5	30·5	30·0	33·0	33·8	34·6	30·5	32·1	30·5	32·5	31·8	31·7	30·4	26·3	26·5	26·0	25·0	24·5	22·3	23·0	23·9	24·4	24·3	25·5

APPENDIX III—*concld.*

Interval from bud to flower. Strain No. 632. 1921-22.

Days	April			May											June										July	
	22	25	28	1	4	7	10	13	16	19	22	25	28	31	3	6	9	12	15	18	21	24	27	30	3	6
14	..	2	..	1	..	4	3	1	1	1	1	2	..	2	1	..	..	..	..	..	..	1	..	..	..	..
16	..	3	5	2	1	5	4	1	3	2	..	2	1	1	..	3	1	..	..	1	1	..	..	..	..	..
18	5	2	..	2	4	10	1	2	2	4	1	1	..	6	..	2	..	1	..	2	..	1	..	2	..	..
20	6	1	3	5	3	17	5	2	1	9	3	2	1	9	7	5	4	2	2	2	1	2	1	2	..	..
22	8	15	6	10	11	26	9	3	21	13	17	17	10	19	16	8	8	7	1	5	..	3	1	4	..	1
24	25	26	17	10	6	34	21	10	33	19	49	45	12	26	20	15	24	15	6	1	..	11	1	3	1	..
26	25	35	25	23	9	34	16	14	31	26	40	36	19	29	28	23	21	22	8	8	10	8	3	3	6	1
28	16	23	5	13	5	15	16	4	9	12	11	14	9	13	19	16	21	16	15	8	11	11	6	8	4	2
30	8	6	4	4	1	8	5	1	2	3	1	9	3	10	2	6	14	16	8	11	9	2	5	5	..	1
32	3	1	2	1	2	1	..	..	2	1	1	1	4	5	1	2	2	5	2	2	4	2	1	..	..	..
34	2	..	2	..	..	1	1	2	1	..	1	4	..	..	2	..	..	4	3	1	1	1	1	..	..	..
36	..	..	..	..	..	1	..	..	..	1	1	1	2	1	..	1	1	..	..	..	2	..	..	..	..	..
38	..	..	1	2	..	..	..	..	..	..	..	1	1	..	..	..	..	..	1	1	1	..	..	..	..	..
40	..	..	..	..	1	1	..	..	..	1	..	..	..	..	..	..	..	1	..	..	..	1	..	..	..	..
42	1	..	..	1	..	..	..	1	1	..	..	1	2	1	..	1	..	2	..	..	..	..	..	..	..	..
44	..	..	..	..	..	..	..	..	..	1	..	1	..	..	..	1	..	1	..	..	..	..	..	..	..	..
46	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
48	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
52	1	..	1	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
54	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
56	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
58	..	1	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..
60	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
62	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..
64	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
75	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
TOTAL	100	116	71	74	43	157	81	41	107	94	126	138	64	123	96	83	96	92	46	42	45	43	19	27	11	5
Average	25·8	25·6	25·6	25·3	24·2	23·8	24·4	25·1	24·6	25·0	24·8	25·5	26·3	25·1	25·1	25·7	26·0	27·6	27·8	26·8	28·1	26·0	27·8	25·5	26·7	26·8

Appendix IV.

Interval from Flower to Boll. Strain No. 632. 1921-22.

Days	December								January											February					
	8	11	14	17	20	23	26	29	1	4	7	10	13	16	19	22	25	28	31	3	6	9	12	15	18
34	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.	..	.	..	..	..	..	..
36	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.	..	..	..	..	..
38	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.	..	..	..	..	..
40	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
42	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
44	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..
46	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
48	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	1	.	..	1	..	1	..
50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	3	2
52	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	2	..	1	4	2
54	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	2	..	4	7	5	6	1	10	7	4
56	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	4	6	5	6	2	8	9	6	7	2
58	..	..	..	1	..	..	..	..	..	..	..	1	..	4	..	7	7	4	12	4	8	1	2	1	3
60	..	..	..	..	..	..	..	..	..	..	..	..	3	2	1	10	6	12	6	3	4	1	..	1	..
62	..	..	..	..	..	..	..	..	..	..	1	1	..	7	5	5	5	5	3	1	1	..	..	1	..
64	..	1	..	3	1	..	..	..	..	2	..	1	2	2	3	2	3	2	2	..	1	..	..	..	..
66	..	1	1	3	2	1	..	..	..	1	1	1	2	2	2	1	..	..	..	..	..	..	..	..	..
68	..	..	..	1	..	..	1	..	..	1	1	..	1	..	..	..	..	..	..	..	..	..	..	..	..
70	..	1	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
72	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
74	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	..	2	1	6	3	2	1	..	1	4	2	4	8	17	13	32	26	32	37	17	30	13	19	26	13

APPENDIX IV—*contd.*

Interval from Flower to Boll. Strain No. 632. 1921-22.

Days	February			March										April										May
	21	24	27	2	5	8	11	14	17	20	23	26	29	1	4	7	10	13	16	19	22	25	28	1
34	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..	3	..
36	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	1	..	..	..	1	..	1	3
38	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	3	2	5
40	..	..	..	..	..	..	..	1	1	..	1	..	1	..	..	..	1	..	5	3	7	1	5	4
42	..	..	..	..	..	..	1	..	2	1	2	..	..	1	..	2	2	7	5	1	6	5	2	2
44	..	..	..	..	..	4	5	..	3	2	1	..	..	1	1	1	1	4	3	2	..	1	1	2
46	1	..	3	1	5	2	10	2	3	3	..	2	1	1	1	4	2	3	..	2	1	2	..	..
48	1	1	1	7	3	3	2	5	4	2	..	..	..	1	..	1	1	..	..	..	..	..	1	..
50	2	..	1	2	1	2	..	4	..	..	..	..	1	..	..	..	..	..	..	..	..	1	..	..
52	6	5	4	2	..	1	1	3	..	..	1	1	..	..	1	..	1	..	..	..	..	..	..	..
54	2	7	..	..	..	..	2	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..
56	2	1	1	..	..	..	1	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..
58	1	1	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..
60	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
62	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
64	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
66	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
68	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
70	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
72	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
74	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
TOTAL	15	15	9	10	9	12	22	15	13	12	5	4	3	4	3	8	11	14	13	8	17	17	14	16

APPENDIX IV—*concld.*

Interval from Flower to Boll. Strain No. 632. 1921-22.

Days	May										June										July			
	4	7	10	13	16	19	22	25	28	31	3	6	9	12	15	18	21	24	27	30	3	6	9	12
34	..	..	..	..	..	1	..	..	..	..	1	..	..	..	..	..	..	..	..	1	..	1	..	1
36	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	1	2	..	1
38	3	..	..	1	..	1	..	..	..	..	1	..	..	1	..	..	1	..	..	..	2	..	..	..
40	..	1	3	..	..	..	3	2	..	..	..	1	..	1	..	..	1	1	..	2	2	..	2	..
42	1	..	3	1	..	..	1	1	1	1	1	1	..	..	1	..	2	1	2	1	2	1	1	1
44	2	..	4	1	1	3	7	..	1	..	2	..	..	2	3	1	2	3	2	1	1	..	..	..
46	3	..	1	..	1	1	2	3	1	7	2	3	..	2	5	6	2	1	1	1	..	..	1	..
48	1	..	1	1	1	1	3	3	5	5	..	1	6	2	3	2	4	3	2	..	..	..	..	1
50	..	..	1	1	..	..	2	3	2	2	3	4	3	5	4	5	2	6	1	..	..	..	..	..
52	..	..	..	..	..	..	..	1	4	1	4	2	2	..	..	3	..	2	..	..	..	..	..	..
54	..	..	1	..	..	..	1	..	1	..	1	4	1	..	1	2	1	..	..	..	..	..	..	..
56	..	..	..	..	..	..	..	..	..	..	1	1	..	..	..	..	..	..	..	..	..	..	..	..
58	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
60	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
62	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
64	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
66	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
68	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
70	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
72	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
74	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
TOTAL	12	2	14	5	3	7	19	13	15	16	16	17	12	13	17	19	15	19	8	6	8	4	4	4

Appendix IV*a*.

Interval from Flower to Boll. Strain No. 632. 1922-23.

	January							February									March					
Days	13	16	19	22	25	28	31	3	6	9	12	15	18	21	24	27	2	5	8	11	14	17
36	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	1	..	..
38	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..
40	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	1	..	1	..	3	..	..
42	..	..	..	..	..	..	..	..	..	..	1	1	2	..	..	..	1	2	..	..	..	..
44	..	..	..	..	..	..	..	..	1	1	..	1	..	1	..	3	1	..	..	2	..	..
46	..	..	..	..	..	..	1	..	..	1	1	..	..	2	2	1	3	1	..	..	..	..
48	..	..	..	..	..	..	..	..	..	1	3	2	4	3	4	2	1	..	..	..	..	..
50	..	..	..	..	..	1	..	1	1	1	3	2	4	1	1	..	..	..	..	..	..	..
52	..	..	1	1	..	1	3	2	..	1	1	..	..	1	..	..	..	..	..	..	..	..
54	..	..	1	..	2	2	2	..	..	..	3	..	..	..	..	..	..	..	..	..	..	..
56	1	..	1	..	..	3	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
58	2	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
60	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
62	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
TOTAL	3	1	3	3	2	7	8	3	2	5	12	6	10	11	8	7	6	4	..	6	2	..

Interval from appearance of bud to shedding of bud. Strain No. 632. 1921-22.

Days	November			December										January										Feb.
	23	26	29	2	5	8	11	14	17	20	23	26	29	1	4	7	10	13	16	19	22	25	28	31	3
0	..	3	..	1	..	..	1	1	..	..	4	7	12	10	11	10	6	1	3	12	19	17	3	..	2
2	..	..	..	..	1	1	..	..	..	..	..	5	2	3	8	2	1	..	3	8	9	4	..	..	..
4	..	..	1	1	..	1	..	..	1	2	..	4	2	2	2	1	2	..	3	4	3	1	..	1	..
6	..	1	..	1	1	..	..	..	2	..	6	3	2	1	1	2	..	5	4	3	1	2	..	..	1
8	1	..	1	..	1	..	..	1	1	1	2	2	1	..	1	..	3	2	5	5	7	10	2	..	4
10	..	..	1	1	1	2	2	..	..	..	1	6	2	3	1	5	2	1	8	5	20	8	1	4	2
12	..	2	..	2	1	3	2	2	3	3	4	5	4	2	2	6	1	3	8	20	25	12	2	2	4
14	..	..	2	1	1	2	1	2	1	1	4	7	2	3	3	3	3	2	15	11	31	7	2	6	9
16	..	..	..	..	..	..	1	1	1	2	2	3	..	2	1	5	2	6	12	26	17	14	1	3	6
18	..	2	1	..	..	2	1	1	..	4	1	3	1	4	1	3	1	1	6	1	20	14	5	2	16
20	..	1	..	1	1	..	1	..	..	1	2	3	1	..	1	1	4	2	2	8	36	18	3	9	17
22	..	1	..	..	2	..	1	1	..	..	..	1	1	..	1	..	1	3	4	3	15	14	3	11	13
24	..	2	..	1	..	..	4	1	1	..	..	3	1	..	3	3	1	..	1	6	16	9	13	10	8
26	..	..	1	..	1	1	1	1	..	..	1	1	1	2	1	1	..	..	2	7	4	16	4	10	6
28	..	1	..	1	..	..	..	..	..	..	2	2	..	1	..	2	..	1	1	3	8	10	7	3	4
30	..	..	1	1	1	1	..	1	..	..	3	3	2	1	..	..	1	2	..	1	15	15	2	4	2
32	..	1	..	1	..	3	1	..	..	..	2	3	1	5	1	2	1	..	..	3	18	10	5	..	2
34	..	..	1	..	..	1	..	1	1	1	..	2	1	2	2	2	..	..	4	6	16	5	1	2	1
36	..	..	..	..	..	..	..	1	..	..	..	..	..	..	4	..	..	1	5	..	6	1	..	..	..
38	..	..	..	2	..	..	..	..	..	..	..	..	..	1	..	..	..	2	3	8	4	3	..	1	1
40	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	1	4	4	6	1	3	..	..
42	..	..	..	..	..	1	..	..	..	..	..	..	..	1	1	..	..	3	2	1	1	1	1	..	..
44	..	..	..	..	..	..	1	..	..	1	..	..	..	..	..	..	..	..	..	1	..	2	..	..	..
46	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..
48	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..
50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
52	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
54	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
56	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
58	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
60	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
62	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
64	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

APPENDIX V—*contd.*

Interval from appearance of bud to shedding of bud. Strain No. 632. 1921-22.

Days	February								March									April							
	6	9	12	15	18	21	24	27	2	5	8	11	14	17	20	23	26	29	1	4	7	10	13	16	19	22
0	2	3	11	11	7	8	11	5	14	9	19	17	9	..	2	3	12	7	7	3	16	21	11	1	12	15
2	..	3	3	4	5	5	5	4	6	2	8	3	8	1	1	3	1	3	4	1	4	5	2	1	4	3
4	..	3	7	12	7	15	11	2	5	4	9	6	4	1	1	6	2	5	2	1	4	3	5	1	12	12
6	..	3	5	27	29	18	9	3	7	6	7	6	8	4	1	2	3	1	11	6	4	3	3	4	12	4
8	..	2	4	18	44	20	13	18	6	9	14	14	6	2	1	2	3	5	..	..	..	9	9	7	15	12
10	..	2	11	22	39	35	18	12	6	10	10	12	7	1	3	4	2	4	..	5	22	9	9	7	15	15
12	..	3	23	21	67	28	22	7	1	9	16	14	9	10	..	2	2	7	3	5	7	13	14	19	23	8
14	..	3	17	42	66	39	16	11	4	6	14	13	9	4	3	3	2	10	4	6	4	14	10	22	12	12
16	..	9	25	29	40	14	10	16	6	6	14	8	9	4	3	2	2	4	7	6	6	15	16	10	12	14
18	..	13	20	12	33	12	18	14	6	9	4	8	9	6	2	2	2	7	4	1	6	12	12	7	16	16
20	..	14	9	12	25	14	20	11	8	12	7	9	6	6	3	3	2	4	3	1	7	7	10	7	16	9
22	..	7	11	6	25	11	14	8	12	3	5	8	8	2	4	1	1	4	..	3	7	6	6	11	12	7
24	..	4	2	3	19	13	8	12	11	7	1	4	4	4	6	2	1	4	..	1	6	9	4	7	3	4
26	..	5	1	3	13	7	10	11	7	1	2	12	2	4	6	1	1	2	..	..	7	4	4	7	2	2
28	..	2	2	5	9	4	10	5	1	..	..	4	6	3	6	1	1	2	..	..	4	1	7	2	5	9
30	..	..	1	1	7	8	5	6	10	4	2	10	4	3	3	2	5	3	..	..	1	1	5	..	1	6
32	..	1	..	1	1	4	6	2	4	2	1	4	2	2	5	4	2	1	..	..	2	2	2	4	2	3
34	..	..	..	1	..	1	2	..	2	..	..	1	3	1	..	2	1	1	..	..	..	..	1	..	1	1
36	..	..	..	..	5	2	..	..	1	..	..	..	..	..	..	..	..	..	1	..	..	..	1	..	1	2	1
38	..	..	..	2	..	1	1	..	..	1	2	..	2	..	..	1	..	..	..	..	..	..	..	..	1	..	..
40	..	1	..	..	..	1	..	1	1	..	..	..	1	..	..	..	..	1	..	..	1	..	..	..	1	1	..
42	..	..	..	..	1	1	..	..	..	..	1	1	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..
44	..	..	..	..	2	..	1	..	..	2	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	1
46	..	1	..	..	..	1	..	1	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
48	..	..	..	..	1	..	..	..	1	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..
50	..	..	..	..	..	..	1	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
52	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
54	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
56	..	..	..	..	..	..	..	..	..	..	..	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..
58	..	..	..	..	..	1	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
60	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
62	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
64	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

APPENDIX V—*concld.*

Interval from appearance of bud to shedding of bud. Strain No. 632. 1921-22.

Days	April		May						June														July		
	25	28	1	4	7	10	13	16	19	22	25	28	31	3	6	9	12	15	18	21	24	27	30	3	6	
0	16	8	7	5	7	12	4	2	21	10	15	14	6	14	17	8	10	6	4	2	5	2	1	6	4	558
2	10	8	5	..	..	10	1	3	17	4	5	3	4	8	1	3	10	4	2	..	4	..	1	4	1	243
4	10	1	9	3	4	6	6	1	5	12	8	10	4	8	4	7	10	6	2	5	4	2	3	5	6	319
6	13	3	3	3	1	5	7	3	15	18	10	11	10	6	4	7	5	2	3	2	1	10	3	15	2	392
8	12	2	20	2	6	12	10	5	16	13	12	9	6	13	8	11	7	8	4	3	3	5	1	11	7	506
10	3	5	13	4	9	18	7	3	11	19	12	15	14	8	6	11	10	8	3	6	9	5	10	4	2	584
12	6	16	9	3	7	20	5	5	24	11	11	14	5	10	6	4	6	15	2	14	2	3	3	6	..	665
14	11	16	9	9	5	14	5	3	13	13	9	16	4	13	5	7	8	4	8	6	6	8	..	10	..	671
16	8	3	6	5	3	19	8	6	9	11	9	11	6	3	4	3	7	6	2	5	2	5	2	3	1	514
18	4	8	8	1	6	8	4	3	7	4	7	7	4	3	4	10	4	13	2	2	1	1	1	5	1	461
20	4	6	6	..	3	5	3	4	7	4	5	7	6	4	3	2	6	3	..	4	..	1	1	..	..	405
22	7	8	6	1	1	11	3	3	3	3	2	2	2	3	2	2	4	1	3	4	2	..	2	1	..	342
24	4	3	6	2	3	2	2	..	4	3	6	2	1	5	..	3	1	3	1	1	2	..	..	2	..	280
26	4	2	7	2	4	1	..	..	1	6	2	4	..	2	3	1	5	3	..	..	..	1	..	1	..	233
28	6	1	2	2	1	..	..	2	1	2	1	5	1	..	4	3	1	3	..	1	..	..	..	..	1	187
30	2	3	2	..	..	3	..	..	1	..	5	1	2	4	..	..	1	..	..	..	2	1	..	2	..	168
32	4	..	3	..	2	..	..	1	..	1	1	1	2	..	..	..	..	..	..	..	..	..	..	..	..	128
34	1	..	..	..	..	..	..	..	..	2	..	1	..	..	1	..	1	..	1	..	..	..	..	..	..	92
36	1	..	..	..	1	..	..	..	..	..	1	..	..	..	1	..	..	..	..	..	..	..	..	..	..	46
38	..	..	..	..	..	..	..	..	1	..	..	1	..	..	..	..	..	1	1	..	..	..	..	..	..	49
40	1	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	47
42	..	..	..	..	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	22
44	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	16
46	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	11
48	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	11
50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
52	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1
54	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2
56	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2
58	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2
60	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1
62	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
64	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1

APPENDIX VI.

Age of bud When shed	1921-1922				1922-23	TOTAL
	Strain No. 769		Strain No. 632		Strain No. 632	
	First flush	Second flush	First flush	Second flush	First flush	
Days						
40 . . .	19	1	37	10	1	67
38 . . .	24	6	36	13	2	81
36 . . .	26	5	36	10	3	80
34 . . .	29	7	68	24	9	137
32 . . .	40	9	90	38	8	185
30 . . .	47	15	103	65	8	238
28 . . .	54	28	110	77	20	289
26 . . .	58	43	149	84	24	358
24 . . .	85	67	178	102	33	465
22 . . .	94	73	203	139	29	538
20 . . .	133	101	249	157	42	682
18 . . .	166	125	250	211	41	793
16 . . .	185	137	288	226	74	910
14 . . .	200	181	367	304	86	1138
12 . . .	253	186	351	314	91	1195
10 . . .	190	211	275	309	52	1037
8 . . .	181	201	230	276	71	959
6 . . .	126	203	171	221	44	765
4 . . .	104	124	123	196	42	589
2 . . .	124	115	99	144	32	514
0 . . .	280	226	248	310	172	1236
TOTAL .	2418	2064	3661	3236	884	..

Appendix VII.

Interval from opening of flower to shedding of boll. Strain No. 632. 1921-22.

	December							January											February							
Days	11	14	17	20	23	26	29	1	4	7	10	13	16	19	22	25	28	31	3	6	9	12	15	18	21	24
0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1
2	..	..	..	..	..	1	1	3	..	1	..	1	1	3	1	12	..	..	..	1	..	..	..	..	2	3
4	..	1	2	..	..	1	..	1	..	..	..	1	..	1	..	..	..	1	2	2	1	..	1	1	..	..	2
6	..	..	1	..	..	1	..	2	2	3	2	..	1	2	2	1	..	..	4	1	1	4	3	1	..	2
8	..	..	..	..	..	1	3	1	3	4	..	2	2	2	2	1	4	1	5	2	2	12	9	9	2	2
10	..	1	..	1	1	2	..	1	2	1	1	1	2	2	2	2	2	1	15	15	2	46	36	3	1	2
12	1	..	1	..	2	3	..	..	1	3	1	3	3	3	4	3	3	4	34	24	1	34	31	9	2	2
14	1	..	1	1	1	2	1	1	1	3	1	7	5	3	3	3	1	5	25	10	2	12	16	38	1	2
16	..	..	1	..	..	1	..	..	1	2	1	3	1	3	5	3	1	3	11	11	..	6	5	16	2	1
18	..	..	..	1	..	1	1	1	1	1	1	11	1	2	4	3	1	3	4	1	..	3	1	1	1	..
20	1	..	..	..	1	1	..	..	..	1	1	..	..	..	..	5	1	..	10	2	..	..	1	..	..	..
22	..	..	..	..	..	..	..	..	..	1	..	..	..	1	1	..	..	1	..	1	1	..	..	..	..	..
24	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	1	..	2	..	..	..	..	..
26	..	..	..	..	..	1	..	..	..	..	..	..	..	..	1	..	1	1	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	1	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..
40	..	..	..	..	..	..	..	..	..	..	..	..	..	3	..	..	1	..	..	..	1	..	..	..	..	..
50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	3	..	..	..	..	..	..	1	..
60	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
70	..	..	..	..	..	..	..	..	1	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
80	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	4	2	6	3	5	14	12	10	10	23	23	37	25	31	39	29	26	27	45	100	94	120	104	110	74	63

APPENDIX VII—*contd.*

Interval from opening of flower to shedding of boll. Strain No. 632. 1921-22.

Feb.	March										April										May				
Days	27	2	5	8	11	14	17	20	23	26	29	1	4	7	10	13	16	19	22	25	28	1	4	7	10	13
0	1	1	1	1	1	1				4	1				1		1		3	4	16	2	3	6	1	14
2	1	4	1	1	1					4					3		3		2	14	21	9	26	11	3	16
4	6	14	25	21	4			1	1				1	2	5	11	12	11	14	23	21	30	28	15	33	26
5	20	22	16	15	2	2		6	3				1		4	3	1	2	8	14	10	19	18	20	13	27
6	12	8	11	24	2	1		1	1						2	1		1	4	4	4	7	11	19	4	10
7	2		1	15	1										5			1	3			6	6	4	1	4
8				6	1										4			1	3			2	4	1		2
9				1											1				1			1	1			1
10															1											
11																										
12																										
13																										
14																										
15																										
16																										
17																										
18																										
19																										
20																										
21																										
22																										
23																										
24																										
25																										
26																										
27																										
28																										
29																										
30																										
32																										
33																										
36																										
40																										
56																										
72																										
80																										
TOTAL	44	65	59	70	37	23	9	15	15	22	16	22	12	11	31	34	46	78	98	82	87	93	126	135	110	94

APPENDIX VII—*concld.*

Interval from opening of flower to shedding of boll. Strain No. 632. 1921-22.

	May						June										July										Aug.
Days	16	19	22	25	28	31	3	6	9	12	15	18	21	24	27	30	3	6	9	12	15	18	21	24	27	30	2
0	..	..	..	..	..	..	2	1	..	1	..	..	..	..	..	..	1	..	1	..	..	..	..	1	..	..	..
2	9	4	3	6	2	3	1	4	2	8	2	2	..	1	4	3	..	1	2	..	1	..	..	2	4	..	..
4	29	26	17	9	9	6	17	8	13	11	14	11	9	2	10	7	6	7	..	3	4	3	1	3	6	1	..
6	25	19	15	20	18	12	17	23	19	21	27	28	13	20	15	12	11	9	8	6	10	9	9	5	2	..	..
8	17	10	13	16	11	15	17	14	12	9	27	21	11	20	13	18	18	23	19	21	10	11	11	6	4	1	1
10	7	5	12	7	7	6	5	8	4	1	15	5	13	11	12	15	10	12	5	6	7	9	6	..	7	6	2
12	..	2	4	2	3	1	2	5	..	1	1	5	3	7	11	7	11	5	2	1	1	3	1	2	1	1	..
14	3	1	4	2	3	1	1	..	1	..	5	3	4	3	2	2	4	1	1	3	..	4	..	..	3	1	..
16	1	1	1	..	..	2	1	..	..	..	2	..	1	3	3	5	6	1	2	4	4	1	..	..	1	..	..
18	..	..	..	..	..	..	..	1	..	..	..	..	..	2	1	1	..	18	1	1	..	..	..	..	..	1	..
20	2	..	..	..	2	..	..	1	..	1	2	1	..	2	..	1	..	1	2	1	..	..	1	..	..	..	..
22	..	..	..	1	1	..	..	1	1	..	..	2	..	2	..	..	..	1	..	..	..	..	..	..	..	..	..
24	1	..	..	2	..	1	..	1	2	..	..	..	1	..	..	..	..	1	..	..	1	..	..	..	..	..	..
26	1	..	..	..	..	1	..	..	..	..	..	..	..	..	..	1	1	..	..	..	..	..	..	..	..	..	..
28	1	..	..	..	..	..	..	..	..	..	..	2	1	1	..	..	1	..	..	..	..	1	..	1	..	..	..
30	1	..	1	..	1	..	..	..	..	..	..	..	..	..	1	3	..	..	1	..	..	..	..	..	..	..	..
40	..	3	5	1	2	3	3	1	3	3	4	..	1	2	1	3	3	1	2	..	..	2	..	..	..	..	..
50	..	6	8	5	1	3	2	1	4	2	4	1	2	1	1	..	3	..	1	..	..	..	..	..	..	..	..
60	..	..	..	..	..	1	1	1	..	..	..	..	..	1	..	..	1	..	..	..	..	..	..	..	..	..	..
70	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
80	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
TOTAL	88	71	83	71	60	55	59	70	61	63	102	83	59	78	77	75	76	81	47	46	38	43	30	20	29	14	1

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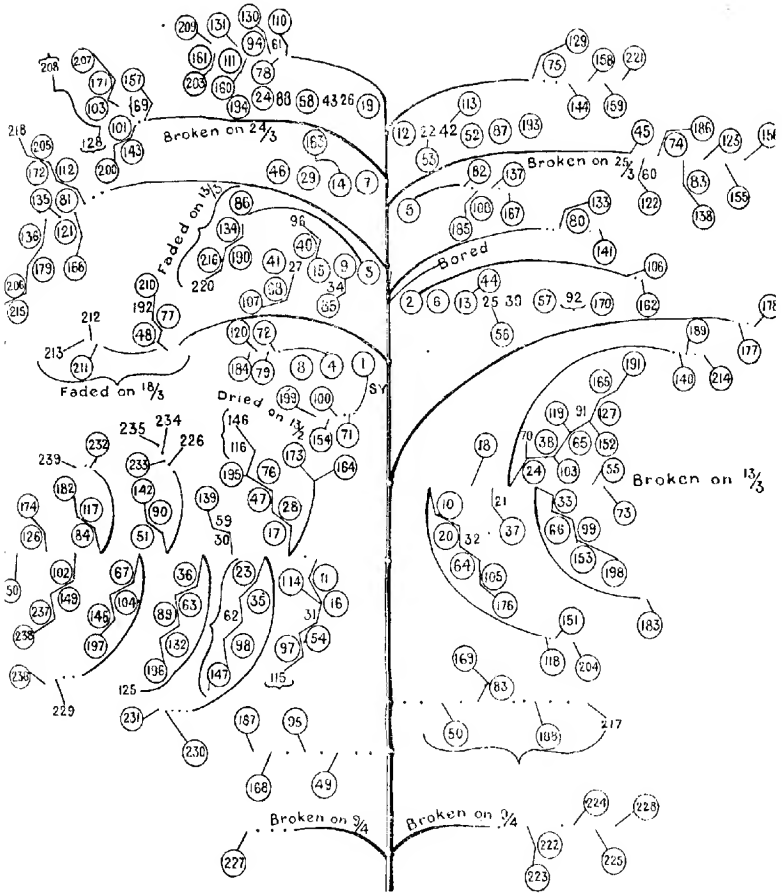


Fig. 1. "Diagram Sheet" of the Cotton plant examined.

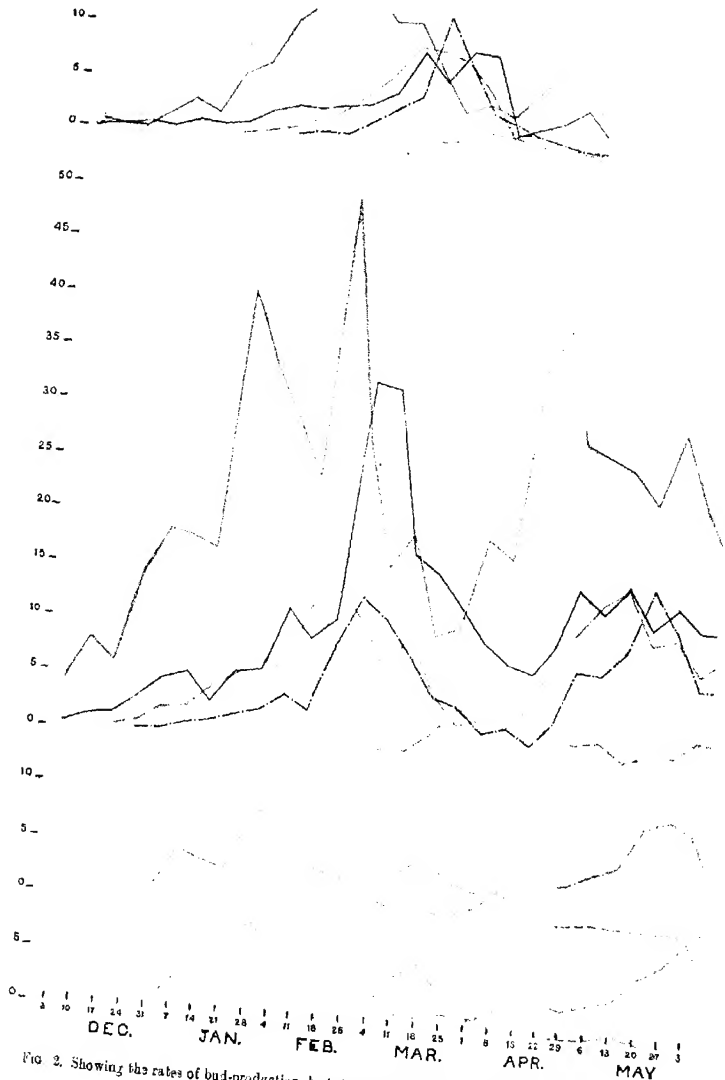


FIG 2. Showing the rates of bud-production, bud-shedding, flowering, boll-shedding and bolling of Cambodi

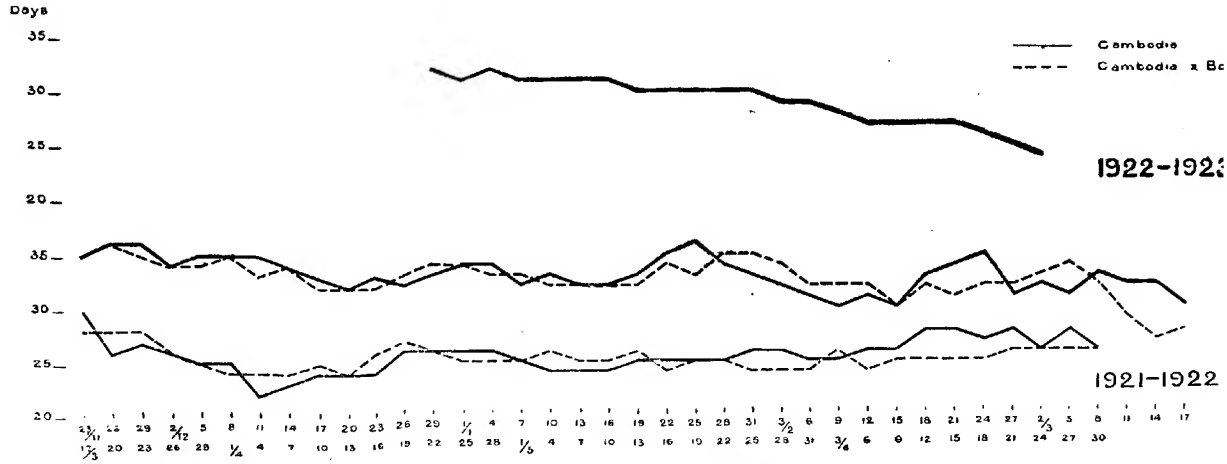
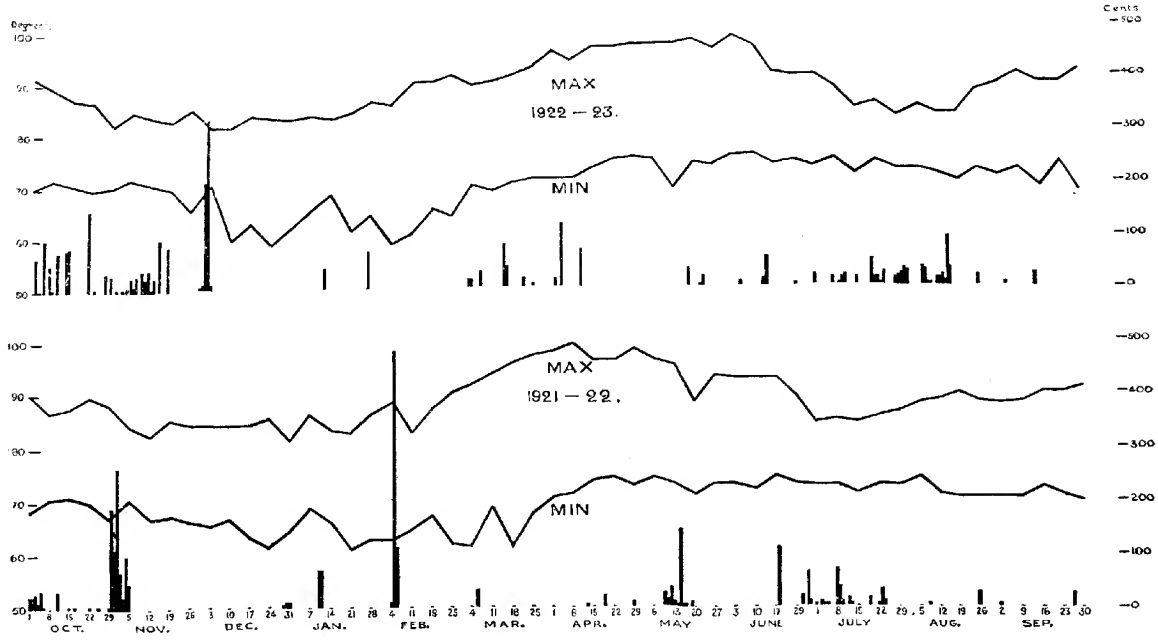


FIG. 3. Showing interval from bud to flower.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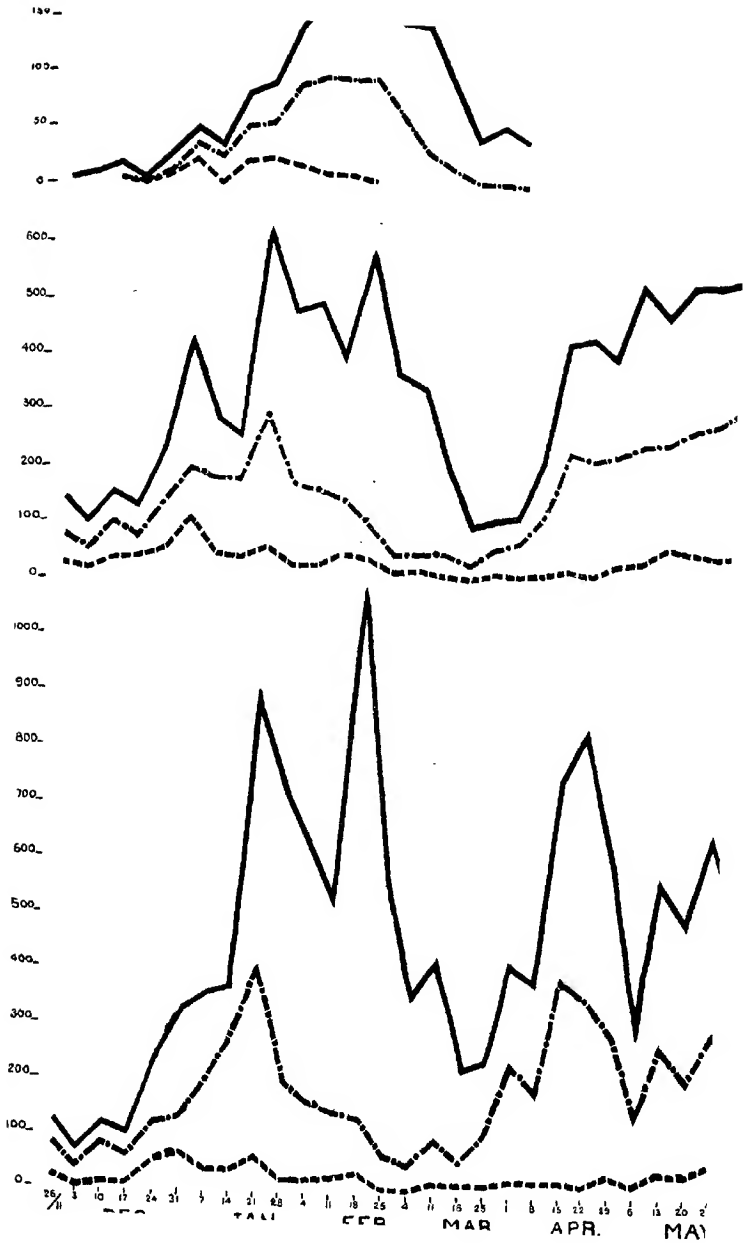
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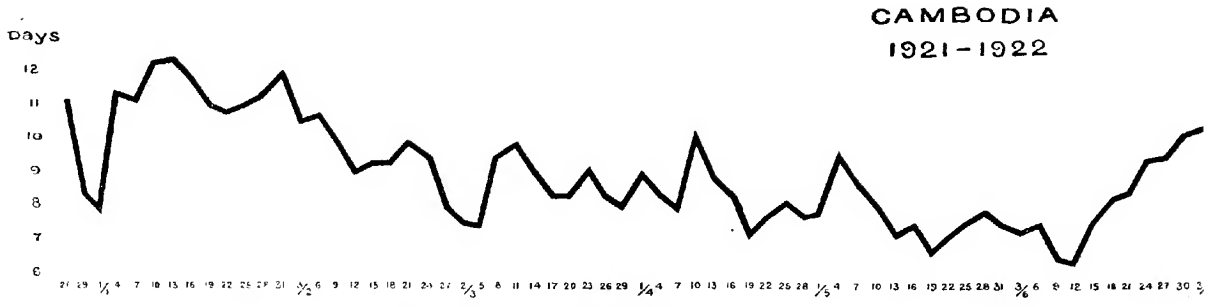

FIG. 6. Showing interval from Flower to Shedding of Bolls.

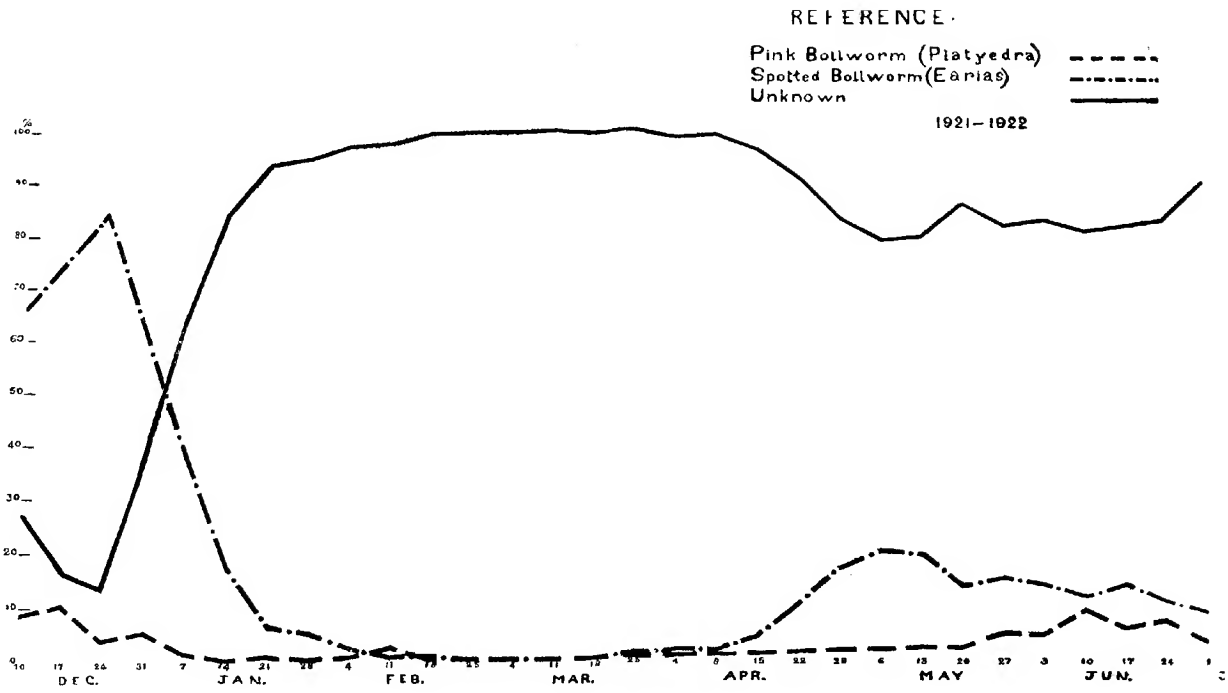

FIG. 7. Showing the analysis of buds and bolls shed according to different agencies.

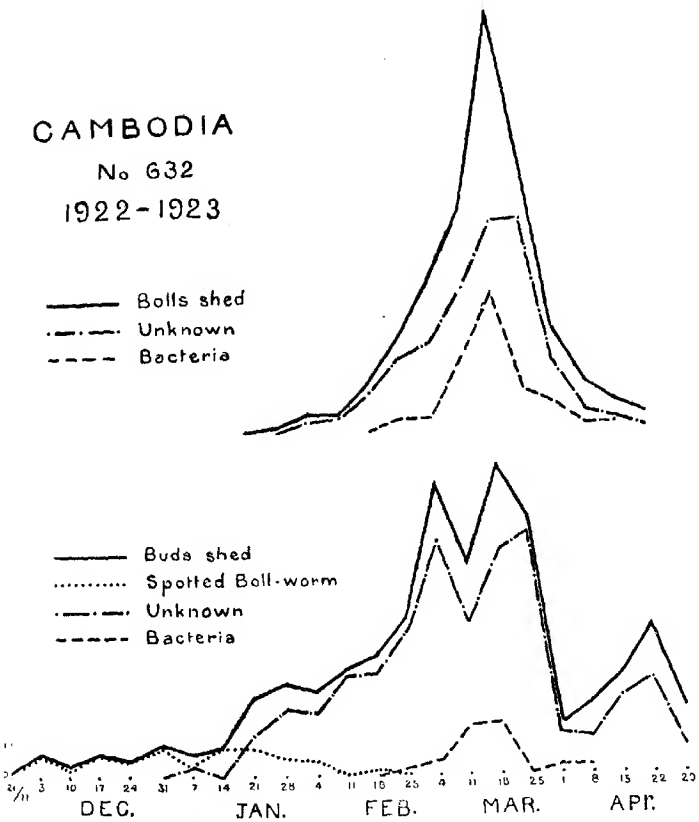

Fig. 8. Showing the relative rates of bud and boll-fall, caused by pink bollworm, spotted bollworm and bacteria or by unknown agencies.

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